Claims

1. Method of producing a composite material, which comprises the following steps:
   a) providing a hydrogel containing at least one further component that precipitates or forms a solid phase when an electrical field is applied to said hydrogel,
   b) applying an electrical field to said hydrogel,
   c) inducing a structuring operation, preferably a pore formation operation, in said hydrogel.

2. Method according to claim 1, in which the steps b) and c) are carried out together in view of time, one before or after the other, or in such a manner that one of the two steps is started after the respective other one has commenced but before the other step has been completed.

3. Method according to anyone of the previous claims, characterized in that step c) is carried out by freezing the hydrogel and/or freeze-drying the hydrogel and/or by electrolysis of water and/or by electrolysis of aqueous solutions in the hydrogel.

4. Method according to anyone of the previous claims, characterized in that step b) is carried out by means of at least two electrodes of opposite polarity.

5. Method according to anyone of the previous claims, characterized in that in step b) said at least one further component, which precipitates or which forms a solid phase when an electrical field is applied to the hydrogel , forms a crystalline and/or amorphous phase or a combination of crystalline and amorphous phases.

6. Method according to anyone of the previous claims, characterized in that in step b) a voltage of 3 V to 20 V is applied to the hydrogel and/or an electric current of an amperage of 0.5 A to 5 A flows through the hydrogel, preferably over a period of 0.5 minutes to 120 minutes.

7. Method according to claim 6, characterized in that the applied voltage is a direct voltage or an alternating voltage.

8. Method according to anyone of the previous claims, characterized in that the hydrogel is a hydrogel of one or more compounds selected from the group that comprises collagen, in particular type I and type II collagen, telopeptide-free collagen, collagen hydrolysates, proteoglycanes, glycosamino glycanes, polymethacrylic acids, polymethacrylates, polyvinyl pyrrolidone, polyvinyl alcohol, gelatin, polyglycolic acid, polylactic acid, copolymers of polylactic acid and polyglycolic acid, glucose, lipids, phospholipids, urates, hyaluronic acid, derivatives of hyaluronic acid, in particular esters of hyaluronic acid, as well as ionic components selected from the group comprising Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, HCO_3^-, HPO_4^{2-}, SO_4^{2-}, F^-.

9. Method according to anyone of the previous claims, characterized in that said at least one further component that precipitates or forms a solid phase when an electrical field is applied to the hydrogel is selected from the group comprising calcium carbonates, calcium phosphates, in particular hydroxyl apatite, tri-calcium phosphates, brushite, octa-calcium phosphate, amorphous calcium phosphate, tetra calcium phosphate, monetite, calcium-deficient hydroxyl apatite, as well as compounds formed of ionic components selected from the group comprising Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, HCO_3^-, HPO_4^{2-}, SO_4^{2-}, F^-.

10. Method according to anyone of the previous claims, characterized in that the hydrogel comprises a component which is electrically conductive, with this component being identical to or different from said at least one further component which precipitates or forms a solid phase when an electrical field is applied to the hydrogel.

11. Method according to claim 10, characterized in that the electrically conductive component is incorporated into the hydrogel or applied to the hydrogel.

12. Method according to anyone of claims 10 - 11, characterized in that the electrically conductive component is chemically and/or biologically inert.

13. Method according to claim 12, characterized in that the electrically conductive component is selected from the group comprising precious metals, in particular elementary gold and/or platinum, as well as carbon, especially graphite.

14. Method according to anyone of claims 11 - 13, characterized in that the electrically conductive component is incorporated into the hydrogel and is there distributed homogeneously or non-homogeneously.

15. Method according to anyone of claims 11 - 13, characterized in that the electrically conductive component is applied to a surface of the hydrogel, and is structured by way of a surface treatment.

16. Method according to anyone of the previous claims, characterized in that the hydrogel is present as a layer wound up before or after realization of step b) and/or step c).

17. Method according to anyone of the previous claims, characterized in that the hydrogel is chemically and/or physically cross-linked.

18. Method according to anyone of claims 3 - 17, characterized in that freeze-drying is performed by freezing the hydrogel to a temperature in the range between –1 °C and –196 °C with subsequent sublimation.

19. Method according to claim 18, characterized in that the freezing of the hydrogel is carried out in a directional and/or non-directional mode, preferably from one and/or several sides of the hydrogel.

20. Method according to anyone of claims 18 - 19, characterized in that the freezing of the hydrogel takes place over a period of approximately thirty minutes to four hours.

21. Composite material produced by a method according to any one of the previous claims.

22. Composite material according to claim 21, characterized by a pore-containing layer of a gel, preferably a partially hydrated hydrogel or a xerogel to which a solid phase, preferably a crystalline and/or amorphous phase or a combination of crystalline and/or amorphous phases in linked.

23. Composite material according to anyone of claims 21 - 22, characterized by a pore size ranging from 10 μm to 150 μm.

24. Composite material according to anyone of claims 21 - 23, characterized in that the solid, preferably crystalline and/or amorphous phase or the combination of crystalline and/or amorphous phases, is a calcium phosphate.

25. Composite material according to anyone of claims 21 - 24, further comprising at least one substance promoting cell growth or cell colonization or cell adhesion.

26. Composite material according to claim 25, characterized in that said at least one substance promoting cell growth or cell colonization or cell adhesion, is a growth factor or a fetal serum or poly-L lysine, the growth factor being preferably selected from the group comprising substances of the TGF-β super family, in particular TGF-β1, and the fetal serum being an animal fetal serum, for example fetal calf serum.

27. Composite material according to claim 25, characterized in that said at least one substance promoting cell growth or cell colonization or cell adhesion, is a serum which is of autogenous, syngenous, allogenous or xenogenous origin.

28. Composite material according to anyone of claims 21 - 27, characterized in that it further comprises biological cells, preferably human or animal cells or plant cells.

29. Use of a composite material according to anyone of claims 21 – 28 as a substrate material for carrying biological cells, preferably human or animal cells or plant cells.

30. Use of a composite material according to anyone of claims 21 – 28 as tissue replacement in human or animal bodies.

31. Use of a composite material according to anyone of claims 21 – 28 as a substrate material for carrying biologically and/or chemically and/or catalytically active substances in the fields of sewage treatment, filtration, bioreactor technology and/or catalysis.